

LAND RECLAMATION COMMISSION

STATE OF MISSOURI

P.O. BOX 176

JEFFERSON CITY, MISSOURI 65102

573-751-4041

Permit To Engage in Surface Mining

LAND RECLAMATION COMMISSION

ISSUES TO

DILLON LLEWELLYN, L.L.C.

Pursuant to "The Land Reclamation Act," RSMo, 2001, and on conformity with the statements

In the application, a permit is hereby granted to engage in surface mining of
traprock in the state of Missouri. The extent of the

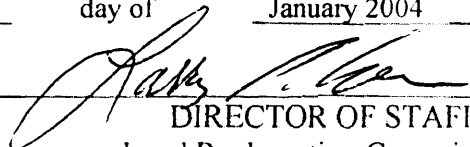
Proposed mining operation(s) will be on eight acres, more or less.

The locations of the operation(s) under this permit is/are as follows: Renewal

County	Section	Township	Range	Acres Renewed	Acres New	Total Acres	Site/Stream Name	Site Number
Iron	12	34N	03E	8	0	8	MB Traprock	1952

This permit may be suspended or revoked upon violation of any or all of the conditions set forth in "The Land Reclamation Act," RSMo. 2001, or in such rules and regulations as are promulgated pursuant thereto by the Land Reclamation Commission.

IN WITNESS WHEREOF I have hereunto set my hand this 21st day of January 2004



DIRECTOR OF STAFF
Land Reclamation Commission

Permit No. 0911

Effective Date 01/21/2004

Expiration Date 01/09/2005

MIO 780-1122 (6-95)

RECEIVED



MISSOURI DEPARTMENT OF NATURAL RESOURCES
LAND RECLAMATION COMMISSION
PERMIT RENEWAL FOR INDUSTRIAL MINERAL MINES

JAN 12 2004

P.O. BOX 176
JEFFERSON CITY, MO 65102-0176

MISSOURI LAND

RECLAMATION COMMISSION

NAME OF CORPORATION, COMPANY, PARTNERSHIP OR INDIVIDUAL

Dillon Hewellyn, LLC

12/30/03

ADDRESS

6435 S. Pontiac Ct

CITY

Englewood

STATE

CO

ZIP CODE

80111

CONTACT PERSON

Mitch Albert

TELEPHONE NUMBER

303-741-2556

FEES: COMPLETE SECTION I OR SECTION II

SECTION I. Fees: Open pit operators and those mining more than 5,000 tons of sand and/or gravel:

1. To compute the site fee complete the information below:

SITE NAME OR NUMBER (add a separate sheet for additional sites)	Mark each month that the site will be operated during the permit year	For sites operated less than six months per permit year pay \$150 For sites operated six months or more per permit year pay \$300
1. MB TRAPROCK	Jan (Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec)	\$ 300.00
2.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
3.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
4.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
5.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
6.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
7.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
8.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
9.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
10.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$

TOTAL SITE FEE

\$ 300.00

2. Acreage Fee \$5 X 8 number of acres bonded

\$ 40.00

3. Annual Permit Fee.....\$ 500

4. Total Fee (Add totals from 1, 2 and 3).....\$ 840.00

NOTE: If Total Fee exceeds \$2,500.00 then pay only.....\$ 2,500

SECTION II. FEES: Sand or gravel operators mining less than 5,000 tons per year:

1. Annual Permit Fee.....\$ 300

SIGNATURE OF APPLICANT

Mitch Albert

TITLE

Manager

DATE

1/6/04

Appeared before me this 06th day of January, 2004. Mitchell Albert
to me personally known, who executed the above as their free acts and deeds.

NOTARY PUBLIC EMBROIDERED SEAL

STATE OF

Colorado

COUNTY (OR CITY OF ST. LOUIS)

Denver

SUBSCRIBED AND SWORN BEFORE ME, THIS

6th DAY OF January YEAR 2004

NOTARY PUBLIC SIGNATURE

[Signature]

MY COMMISSION EXPIRES

2/14/07

NOTARY PUBLIC NAME (TYPED OR PRINTED)

Shawn Shaffer

USE RUBBER STAMP IN CLEAR AREA BELOW.

My Commission Expires

FOR DEPARTMENT USE ONLY: APPROVED BY

DATE APPROVED

1-13-04

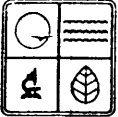
PERMIT NUMBER

0911

EXPIRATION DATE

1-9-2005

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MISSOURI DEPARTMENT OF NATURAL RESOURCES
LAND RECLAMATION COMMISSION
PERMIT RENEWAL FOR INDUSTRIAL MINERAL MINES

JAN 5 2004

P.O. BOX 176
JEFFERSON CITY, MO 65102-0176

NAME OF CORPORATION, COMPANY, PARTNERSHIP OR INDIVIDUAL Dillon Hewellyn, LLC		MISSOURI LAND RECLAMATION COMMISSION 12/30/03	
ADDRESS 6435 S Pontiac Ct	CITY Englewood	STATE CO	ZIP CODE 80111
CONTACT PERSON Mitch Albert		TELEPHONE NUMBER 303-741-2556	

FEES: COMPLETE SECTION I OR SECTION II

SECTION I. Fees: Open pit operators and those mining more than 5,000 tons of sand and/or gravel:

1. To compute the site fee complete the information below:

SITE NAME OR NUMBER (add a separate sheet for additional sites)	Mark each month that the site will be operated during the permit year	For sites operated less than six months per permit year pay \$150 For sites operated six months or more per permit year pay \$300
1. MB TRAPROCK	Jan <input checked="" type="checkbox"/> Feb <input checked="" type="checkbox"/> Mar <input checked="" type="checkbox"/> Apr <input checked="" type="checkbox"/> May <input checked="" type="checkbox"/> Jun <input checked="" type="checkbox"/> Jul <input checked="" type="checkbox"/> Aug <input checked="" type="checkbox"/> Sep <input checked="" type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec <input checked="" type="checkbox"/>	\$ 300.00
2.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
3.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
4.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
5.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
6.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
7.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
8.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
9.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$
10.	Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec	\$

TOTAL SITE FEE **\$ 300.00**

2. Acreage Fee \$5 X **8** number of acres bonded **\$ 40.00**

3. Annual Permit Fee **\$ 500**

4. Total Fee (Add totals from 1, 2 and 3) **\$ 840.00**

NOTE: If Total Fee exceeds \$2,500.00 then pay only **\$ 2,500**

SECTION II. FEES: Sand or gravel operators mining less than 5,000 tons per year:

1. Annual Permit Fee **\$ 300**

SIGNATURE OF APPLICANT	TITLE	DATE
------------------------	-------	------

Appeared before me this _____ day of _____, 20____
to me personally known, who executed the above as their free acts and deeds.

NOTARY PUBLIC EMBOSSEER SEAL	STATE OF _____		COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS _____ DAY OF _____ YEAR _____		
	NOTARY PUBLIC SIGNATURE _____		USE RUBBER STAMP IN CLEAR AREA BELOW.
	MY COMMISSION EXPIRES _____		
NOTARY PUBLIC NAME (TYPED OR PRINTED) _____			

FOR DEPARTMENT USE ONLY: APPROVED BY [Signature]	DATE APPROVED 1-13-2004	PERMIT NUMBER 0911	EXPIRATION DATE 01-09-2005
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MISSOURI DEPARTMENT OF NATURAL RESOURCES
LAND RECLAMATION COMMISSION
SITE INFORMATION FORM

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MISSOURI LAND

RECLAMATION COMMISSION

To be completed for each separate area of disturbance associated with mining operations.

SITE NAME OR NUMBER MB TRAPROCK		PERMIT NUMBER 0911	
COMPANY NAME Dillon Llewellyn LLC			
COUNTY IRON	1/4 SECTION NW4, W2 NE4	SECTION 12	
TOWNSHIP 34N	RANGE 3E	ACRES 250	
RIVER OR STREAM NAME (FOR IN-STREAM ACRES) N/A			
MINERAL COMMODITY TRAPROCK		ESTIMATED TONS/YEAR (FOR GRAVEL SITES) 1,000,000 based on market	

NAME OF LANDOWNER (ATTACH LIST IF MORE THAN ONE) John McManus, LLC		
ADDRESS L3B, CPA, PO Box 20774		
CITY Billings	STATE MT	ZIP CODE 59103
SOURCE OF RIGHT TO MINE (CHECK ONE): <input type="checkbox"/> MINERAL DEED <input type="checkbox"/> WARRANTY DEED <input type="checkbox"/> OTHER (DESCRIBE): _____ <input checked="" type="checkbox"/> LEASE <input type="checkbox"/> VERBAL AGREEMENT		DATE OF AGREEMENT 6/28/02

MINERAL RIGHTS OWNER (ATTACH LIST IF MORE THAN ONE) Same as above "landowner"		
ADDRESS		
CITY	STATE	ZIP CODE
SOURCE OF RIGHT TO MINE (CHECK ONE): <input type="checkbox"/> MINERAL DEED <input type="checkbox"/> WARRANTY DEED <input type="checkbox"/> OTHER (DESCRIBE): _____ <input checked="" type="checkbox"/> LEASE <input type="checkbox"/> VERBAL AGREEMENT		DATE OF AGREEMENT 6/28/02
NOTE: Each site must be shown on a map and be included in a public notice and an approved mine plan.		



MISSOURI DEPARTMENT OF NATURAL RESOURCES
LAND RECLAMATION COMMISSION
MINE PLAN

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MISSOURI LAND
RECLAMATION COMMISSION

P.O. BOX 176
JEFFERSON CITY, MO 65102

COMPANY NAME

Dillon Llewellyn, LLC

TYPE OF PLAN (CHECK ONE):

☐ SHORT TERM, FOR ONE PERMIT YEAR

☒ LONG TERM, FOR PERIOD THROUGH DATE:

2053

DESCRIPTION OF SITE PRIOR TO LAND RECLAMATION COMMISSION PERMITTING (BY APPLICANT OR PRIOR OPERATOR), INCLUDING SOIL, VEGETATION AND TOPOGRAPHY.

The mining project covers area of approximately 250 acres. The western 2/3's of the property is a hillside rising from about 1140' to about 1525'. The land has many areas of rhyolite rock exposed on the surface and is heavily treed. The eastern 1/3 is fairly flat silty grass low lying shrubs. There are 2 pre-existing dirt track roads through the property. The Western 250 acres plus road access is leased by the operator in this application. The eastern 1/3 outside of the mine plan boundaries on the detail map is under lease to a separate lessee railroad contract company.

Topsoil in the mining area is made up of Irondale and Killamey soil groups with 20-50% rock/boulder surface content and a profile of 3" brown cobbly silt loam; 4-5" silt loam; 29-32" subsoil changing from yellowing brown to reddish brown and brown at the bottom. The area is bordered on the west by additional hillside undeveloped areas, a powerline just south of the northern border, a major railroad to the east, a small portion next to a state road "W" in the south east and other property owners to the south.

OPERATION PLAN - 10 CSR 40-10.020(2)(D)1.

A. TOPSOIL

AVERAGE DEPTH OF TOPSOIL, PRIOR TO LAND RECLAMATION COMMISSION PERMITTING

2-8 INCHES

IS TOPSOIL TO BE SOLD OR DISCARDED OFFSITE?

☐ YES ☒ NO

DESCRIBE METHODS AND EQUIPMENT USED FOR TOPSOIL REMOVAL

A. topsoil

Trees and vegetation will be cleared with dozers. The topsoil profile shows 8" of topsoil with 1-50% of the surface being rock, rocky or cobbly. To the extent the surface is not consolidated unoxidized rhyolite, the top 12" or down to the unoxidized rhyolite will be dozed and stockpiled. "Soil Survey of Iron County, MO", USDA, SCS 2/91 indicates that this will result in the needed 12" or more from the surface area. Topsoil removal will be done at limited times as required in advance of mining. (Supplementary page summarizing 4 types of soil identified in mine plane area from county soil survey document and excerpts from the previously mentioned document attached.)

DESCRIBE METHODS AND EQUIPMENT USED FOR TOPSOIL STORAGE AND PROTECTION

The topsoil will be transported to the base of the hill but scrapers or by truck and stockpiled towards the eastern end of the property in such a way to help shield operations from highway travelers. The temporary topsoil stockpile(s) will be shaped with varying heights and widths to aid in visual appearance and seeded to protect from erosion and signed.

PERMIT NO.

SITE NUMBER/NAME

MB TRAPROCK

B. SOIL**DESCRIBE METHODS AND LOCATION OF SPOIL PLACEMENT AND DISPOSAL**

Overburden removed from the quarry surface or process product spoils will be placed in temporary and permanent berm/stockpiles at locations around the property not expected to be required by the railroad lessee to the northeast and east or the mining operations to the north and east. Berm/stockpiles of the material will be built with undulating heights and widths for a more natural appearance. When finished, a 12" depth of topsoil will be placed on the spoil surface and seeded to control erosion. Any spoils intended to be placed back into the completed quarry will be placed in temporary stockpiles but will still be covered by 12" of topsoil and seeded for erosion control until removed and placed in the quarry. Any such spoils placed in the quarry will be sloped 3:1 or less against the bottom toe of the highwall and on the bottom of the quarry when the quarry is finished with 12" of final top soil covering and seeded.

C. ACID MATERIALS**DESCRIBE METHODS AND EQUIPMENT USED FOR HANDLING ACID MATERIALS (IF NONE IS ANTICIPATED, WRITE "NONE" BELOW)**

None

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MISSOURI LAND
RECLAMATION COMMISSION

D. PIT INFORMATION (GIVE ALL DIMENSIONS IN FEET)**DESCRIBE LOCATION AND ORIENTATION OF PIT, IF NOT CLEAR ON SITE MAPS**

The first cut will be in the middle eastern portion of the property at the base of the hill and hill cut to the west to open up development benches for full sized production benches. A total of 8 acres is planned for pit, processing and accesses road disturbance. The existing access road will be shared with the shortline railroad lessee. Processing will include crushing, screening, washing, stockpiling and loading rock products of different sizes. Mining benches will follow the contour of the land, 50' high and 50' wide approximately. The quarry will develop northwest and south while advancing to the west. The mine area will be limited to a 10' buffer away from any property line on the south, north and west while working around the railroad tracks and railroad operations to the east with an access road from the southeast for limited highway transport of products. However, disturbance in the quarry area will have approximately a 50' buffer from the property line. The top of the highwall will be sloped 3:1 towards the property line if the material is disturbed unconsolidated material or left at the original slope if the material is consolidated. The highwall will have a 1:10 to 2.5:10 horizontal:vertical angle subject to rock strength and lateral stability. Mining will bench the mine area to ground level and below so long as such activities are economical. An erosion control berm will be placed at the entrance to the pit and processing areas as shown in the initial production/processing area. The berm will be a gradual rise or swale in the ground to allow vehicle access over the berm. The berm will be constructed so as to allow any water in the pit/processing area to flow to and use the berm as a "filtration" medium retaining any soil picked up by stormwater.

This is a "railroad" based quarry with most shipments planned and expected to depart in railroad cars through the tracks built and operated by the shortline railroad company. There will be limited local truck sales. The access road will be used primarily by workers, vendors, the railroad lessee and other railroad customers with some rock shipments estimated at 10% of the mine's rock sales.

YES NO

☐☒

Will any excavation be at or within fifty feet (50') of the right-of-way of any public road?

☐☒

Will any highwall consisting of unconsolidated materials be left within fifty feet of the right-of-way of any public road? (NOTE: For unconsolidated materials left in place, a slope of no more than forty degrees may start near the right of way, and in no case may the excavation be closer to the right of way than fifty feet or twenty-five feet plus one and one-half (1-1/2) times the depth of unconsolidated material, whichever is greater, unless a variance is granted by the Commission.)

☐☒

Will any excavation start at or within fifty feet (50') of any property line? (NOTE: If the answer is "yes", a safety barrier may be needed.)

PERMIT NO.

SITE NUMBER/NAME

MB TRAPROCK

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RECLAMATION PLAN - 10 CSR 40-10.020(2)(D)2.

A. REVEGETATION (Attach additional sheets, if needed)

MISSOURI LAND

REVEGETATION MIX #1

PURPOSE OR LAND USE

RECLAMATION COMMISSION

B. SEEDING OR PLANTING TIME

Wildlife

Spring (March 15 - May 15)

DESCRIBE METHODS AND EQUIPMENT TO BE USED FOR SEEDING OR PLANTING

During the first spring following topsoil replacement, the seed mix will be broadcast and harrowed. After grass has grown sufficient to control erosion, trees and shrubs will be hand planted.

Lime and fertilizer will be applied according to recommendations made, based on an analysis of soil texture and nutrients. Mulch will be applied to all slopes exceeding 5:1.

SEEDED SPECIES	POUNDS/ACRE	TREE OR SHRUB SPECIES	STEMS/ACRE
Orchard Grass Red Clover Korean Lespedeza Ladino Clover Birdsfoot Trefoil Timothy Ret top	9 6 10 2 6 7 7 47 Total	White Oak Red Maple Gray Dogwood Shagbark Hickory Red Pine	350 average

REVEGETATION MIX #2

PURPOSE OR LAND USE

B. SEEDING OR PLANTING TIME

DESCRIBE METHODS AND EQUIPMENT TO BE USED FOR SEEDING OR PLANTING

Lime and fertilizer will be applied according to recommendations made, based on an analysis of soil texture and nutrients. Mulch will be applied to all slopes exceeding 5:1.

SEEDED SPECIES	POUNDS/ACRE	TREE OR SHRUB SPECIES	STEMS/ACRE

ATTACH ADDITIONAL SHEETS FOR ADDITIONAL SEED MIXES.

PERMIT NO.

SITE NUMBER/NAME

MB TRAPROCK

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B. GRADING

DESCRIBE PROPOSED RECLAIMED TOPOGRAPHY, INCLUDING SLOPES

MISSOURI LAND
RECLAMATION COMMISSION

The final highwall benches will be cut back from 50' to 25' in width. The highwalls at somewhat random locations will be blasted to create talus slopes whose purpose is to enhance the visual appearance of the bench and highwall lines to outside observers. If the top of the highwall to the property line is unconsolidated disturbed material, it will be graded to a 3:1 slope. If the latter area is consolidated and undisturbed, the slope will be left as it was originally. The slope of the pit floor will have a 1-2 degree slope towards one end of the pit floor to control run off and collect water. As the final floor is approached, the floor will be sloped in the direction of a 10 acre pond. (USDA, SCS County soil report notes the desire for wildlife habitat sources of water.) Any excess spoils will be placed against highwalls and the floor with all final slopes at 3:1 or flatter. Any spoils piles outside of the quarry will likewise have a 3:1 slope or flatter. The final 10 acre water retention pond/lake/structure will be designed and built in accordance with NRCS378 standards.

C. DESCRIBE THE GENERAL SEQUENCE AND TIMING OF THE FOLLOWING ACTIVITIES**GRADING**

Grading will be done immediately on the spoils and top soil piles when mining starts and so long as material is added to these piles. Most of the spoils and topsoil will be placed and graded within one year when mining is completed and within one year of permit expiration on all mined out portions.

REPLACEMENT OF TOPSOIL

Topsoil will be replaced to a uniform depth of 12" and disced to reduce compaction. Topsoil will be replaced within one year of permit expiration on all mined out portions.

REVEGETATION

All topsoil areas will be seeded during the first optimum seeding period following topsoil replacement. Topsoil and spoil piles will be seeded as soon as completed and, in the case of spoil piles, layered with 12" of surface topsoil.

AVERAGE DEPTH OF REPLACED TOPSOIL (INCHES)

A Horizon (3 inches) + B Horizon (4-5 inches) + >subsoil (4-5 inches) = 12 inches

D. USE OF LAND WHEN RECLAIMED

Estimate acreage of each land use below, after reclamation

ESTIMATED ACRES:

Wildlife (forest or other habitat with livestock excluded)

250
240

Agricultural (pasture, cropland, and horticultural)

Development (residential, industrial, and recreational)

Water impoundments (for wildlife, agriculture, or development)

10

PERMIT NO.

SITE NUMBER/NAME

MB TRAPROCK

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By my signature, I attest to the following:

MISSOURI LAND
RECLAMATION COMMISSION

1. All statements made on this Mine Plan Form are correct, complete and true, to the best of my knowledge.
2. I or the company I am authorized to represent intend(s) to mine in accordance with this Mine Plan Form, and in accordance with the Missouri Land Reclamation Act, Sections 444.760 through 444.789, RSMo and all rules, regulations, orders, decisions and permits of the Missouri Land Reclamation Commission pertaining to my company's surface mining operations.
3. I have obtained the approval of all landowner's for all proposed post-reclamation land uses.
4. I have a valid agreement with all landowners which gives me the right to grant access to the Director of the Missouri Land Reclamation Commission and his authorized representatives, and I grant such access, and further where I have no such right, I have attached signed affidavits from the landowners, granting such access.

SIGNATURE OF APPLICANT <i>Mark Ashton</i>		TITLE PROJECT Manager		DATE 9/5/02	
NOTARY PUBLIC EMBOSSER OR BLACK INK RUBBER STAMP SEAL	STATE Colorado		COUNTY (OR CITY OF ST. LOUIS) Arapahoe		
	SUBSCRIBED AND SWORN BEFORE ME, THIS 5th DAY OF September YEAR 2002				
	NOTARY PUBLIC SIGNATURE <i>Lyman W. Ashton</i>		MY COMMISSION EXPIRES 7/18/02		
	NOTARY PUBLIC NAME (TYPED OR PRINTED) Lyman W. Ashton		<div style="border: 2px dashed black; padding: 5px;"> LYMAN W. ASHTON NOTARY PUBLIC STATE OF COLORADO My Commission Expires 7/18/2005 </div>		
APPROVED BY (DIRECTOR'S REPRESENTATIVE) <i>William S. Greenman</i>		DATE APPROVED 1-10-03		PERMIT NUMBER 0911	

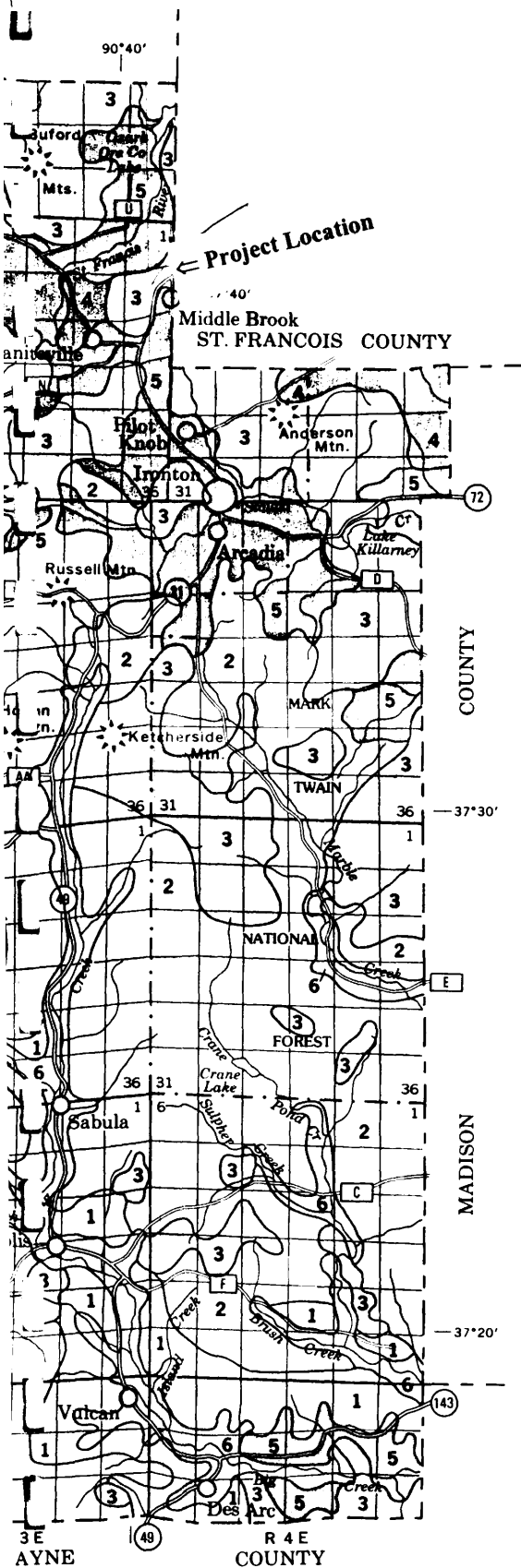
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

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MISSOURI LAND
RECLAMATION COMMISSION

T34N
R3E
Section 12



SECTIONALIZED
TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE AND FOREST SERVICE
MISSOURI AGRICULTURAL EXPERIMENT STATION

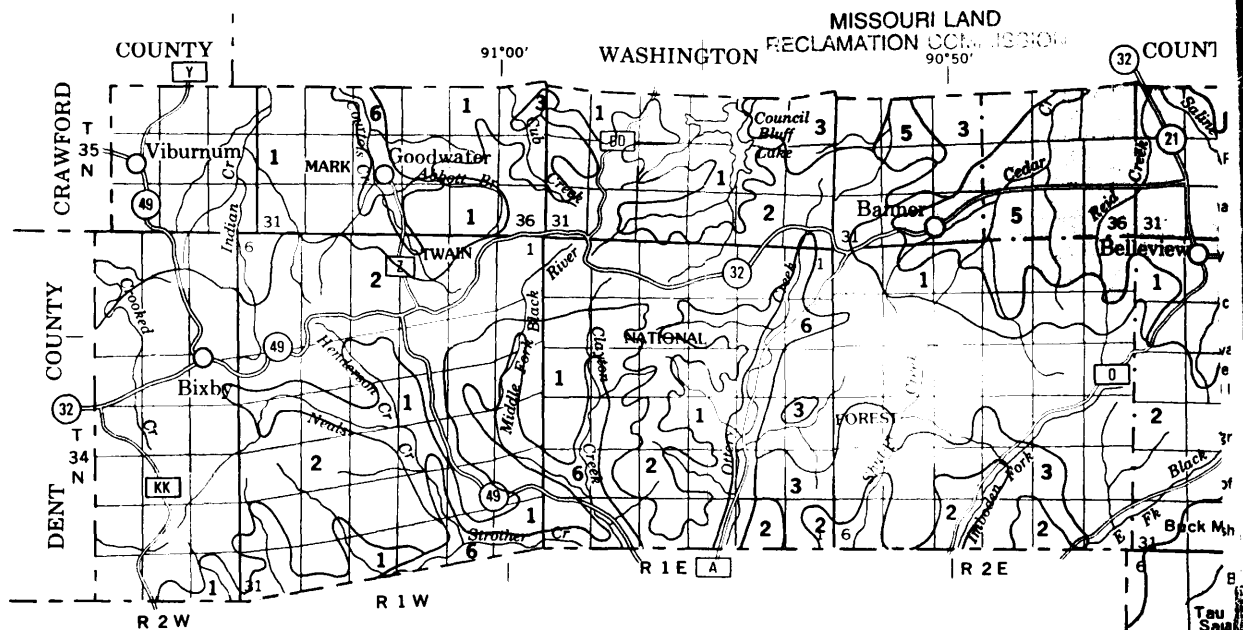
GENERAL SOIL MAP IRON COUNTY, MISSOURI

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

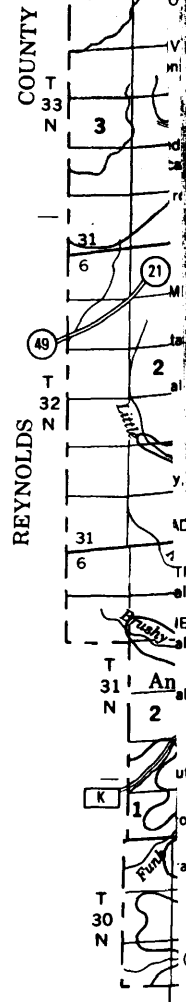
OCT - 7 2002



LEGEND

- 1 GOSS-VIBURNUM ASSOCIATION: Deep, gently sloping to steep, well drained and somewhat poorly drained soils that formed in a thin mantle of loess, in cherty, silty, and clayey sediments, and in cherty, red clay; on uplands of the Salem Plateau
- 2 CLARKSVILLE-WILDERNESS ASSOCIATION: Deep, moderately sloping to very steep, somewhat excessively drained and moderately well drained soils that formed in cherty, loamy sediment; on uplands of the Salem Plateau
- 3 IRONDALE-KILLARNEY-KNOBTOP ASSOCIATION: Moderately deep and deep, gently sloping to very steep, moderately well drained and well drained soils that formed in loess and in stony material weathered from igneous rocks; in the St. Francois Mountains
- 4 DELASSUS-SYENITE ASSOCIATION: Deep and moderately deep, gently sloping to steep, moderately well drained and well drained soils that formed in a thin mantle of loess and in loamy material weathered from granite; in the St. Francois Mountains
- 5 COURTOIS-FOURCHE-GATEWOOD ASSOCIATION: Deep and moderately deep, gently sloping to moderately steep, moderately well drained and well drained soils that formed in loess and in clayey sediment; on ridges and side slopes in valleys and basins
- 6 MIDCO-SECESH-VIRATON ASSOCIATION: Deep, nearly level to moderately sloping, somewhat excessively drained to moderately well drained soils that formed in loamy and gravelly alluvium or colluvium; in stream valleys

Compiled 1989



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MISSOURI LAND
RECLAMATION COMMISSION

T34N
R33N
Sec 12

T. 34 N. T. 35 N.

680 000 FEET



2 MILES

2 KILOMETERS

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RECLAMATION COMMISSION

TOPSOIL SUMMARY DATA

Source: USDA, SCS, Iron County

42F Irondale is the predominant soil. Stones and boulders commonly cover 15-50% of surface. Profile: 3" dark grayish brown cobbly silt loam; silt loam 5"; subsoil silt loam about 32" thick changing from yellowish brown on the surface to reddish brown and brown on the bottom. Rhyolite bedrock is at a depth of about 35". Some of the upper rhyolite for 20" is sometimes weathered on north and east slopes.

Water capacity is low. Fertility is low with low organic matter. Surface tilling is hard due to 50% rock fragment content. This makes the land unsuitable for agricultural purposes but good for trees. The soil is best suited to woodland wildlife habitat. Oak hickory and shortleaf pine grow. The shallow soils support native grasses, sumac, coralberry, bluestem and indiangrass. Small ponds are desired.

10E Killarney is the secondary soil type on the mining area with up to 35% stone/boulder surface content. Profile: 3" dark grayish brown cobbly silt loam; 4" brown cobbly silt loam; 29" yellowish brown to strong brown cobbly silt loam. Rock outcrops are common. Permeability is low and water runoff rapid. Water capacity is low. Not good for agricultural purposes. Vegetation includes crownvetch; lespedeza; tall fescue; Caucasian bluestem; indiangrass.

6C Delassus is the front flat area between the uplift hill and the railroad tracks. Profile: surface layer brown silt loam 2"; yellowish brown silt loam 4"; subsoil brown silty clay loam 23" with fragipan brittle loam below. Permeability is moderate as is water capacity but fertility is low. Most areas when cleared are used for pasture and hay. Many areas remain treed. This area is good for crops. Soils shrink and swell for buildings.

20C Fourche minor amount near middle north power lines. Similar to the other 3. Profile: 7" dark brown silt loam; subsoil 60" yellowish brown silty clay loam to brown silty clay loam to yellowish red mottled silty clay. Permeability is moderate as is runoff. Water capacity is high. Fertility is low. Perched water at 1.5-3' is common. Soil shrinks and swells. Cleared areas good for pasture and hay. Ladino and red clover; smooth brome and orchardgrass; bluestem, indiangrass and switchgrass grow well.

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41D—Gasconade flaggy silty clay loam, 5 to 20 percent slopes, extremely stony. This shallow, moderately sloping to moderately steep, somewhat excessively drained soil is on side slopes and a few ridges in the uplands. Areas of this soil are locally called "glades" or "cedar glades." Stones commonly cover about 10 percent of the surface. Most areas are irregular in shape and range from about 8 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown flaggy silty clay loam about 6 inches thick. The subsoil is very dark gray very flaggy silty clay about 12 inches thick. Hard dolomite bedrock is at a depth of about 18 inches. In some places the surface layer is flaggy clay loam. In other places the soil has less than 35 percent rock fragments.

Included with this soil in mapping are areas of the moderately deep Gatewood and deep Crider soils. These soils occur as small areas, most commonly on foot slopes. Also included are ledges of rock outcrop that form narrow steplike bands across the slope. Included areas make up about 10 percent of the unit.

Permeability is moderately slow in the Gasconade soil. Surface runoff is rapid. The available water capacity is very low. Natural fertility is moderately low, and the content of organic matter is moderate. The surface layer is very friable, but most areas cannot be tilled because of the stones and the shallowness to bedrock. The rooting depth is restricted by the bedrock at a depth of about 18 inches. Some roots grow deeper into the cracks and fractures in the bedrock. The shrink-swell potential is moderate.

Most areas support some native grasses and scattered eastern redcedar, upland oaks, and ash. The trees are used as fenceposts and firewood. This soil is unsuited to cultivated crops because of the surface stones, the rock outcrop, and a severe hazard of drought.

The native grasses can be managed by carefully controlled grazing. They include big bluestem, indiangrass, little bluestem, and sideoats grama. Other drought-tolerant species, such as tall fescue, alsike clover, and common lespedeza, can be seeded. Seedbed preparation and brush control are difficult because of the rough, stony surface and the slope. A pasture can be more easily established and managed in the less stony areas. Some large stones can be removed. The main management concerns are preventing overgrazing and maintaining a good stand. Because of the slope and the shallowness to bedrock, the soil is very susceptible to erosion and the stand can easily deteriorate. Overgrazing causes compaction,

deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

This soil is poorly suited to trees. Because of low productivity, it is best suited to short rotations for small wood products, such as fuelwood and posts. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Hand planting or direct seeding is needed. Logs can be yarded to logging roads that have been cleared of large stones. The seedling mortality caused by drought can be minimized by planting the larger seedlings or containerized nursery stock. Properly managing the stand helps to ensure natural regeneration. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Both woodland and openland wildlife frequent areas of this soil. These areas provide little food, water, and cover. The habitat can be improved by providing water and food plots in nearby areas. Brush piles and treetops can provide cover. Measures that protect the habitat against fire and overgrazing are needed.

Rugged hiking trails can provide limited opportunities for recreation in the unique ecological areas of this soil. Many unique plants and wildflowers and rare species of insects and reptiles are in these glades.

This soil generally is unsuitable for building site development and onsite waste disposal because of the large stones and the depth to bedrock.

The land capability classification is VIIs. The woodland ordination symbol is 2X.

42F—Irondale very cobbly silt loam, 15 to 40 percent slopes, rubbly. This moderately deep, moderately steep to very steep, well drained soil is on generally long, mountainous slopes. Stones and boulders commonly cover 15 to 50 percent of the surface. Areas are commonly elongated or oval and range from about 100 to more than 1,000 acres in size.

Typically, the surface layer is very dark grayish brown very cobbly silt loam about 3 inches thick. The subsurface layer is brown very cobbly silt loam about 5 inches thick. The subsoil is very cobbly silt loam about 32 inches thick. It is yellowish brown in the upper part and reddish brown and brown in the lower part. Rhyolite bedrock is at a depth of about 35 inches. On some north- and east-facing slopes, the upper 20 inches of the bedrock is weathered and can be penetrated to a greater depth by roots. In places the surface layer is cobbly.

Included with this soil in mapping are small areas of

material to the main logging roads minimizes rut formation and miring. In places logging roads can be located on nearby soils that are less prone to rut formation and miring.

This soil is suited to woodland wildlife habitat. The habitat can be improved by providing food, water, and cover in large tracts of mature woodland. Brushy thickets, which are created by clearing small areas, provide habitat diversity. The soil conditions favor the establishment of green browse areas, annual grain plots, and wild herbaceous plants. The soil is suitable for the development of small ponds, which can provide water in areas that are remote from perennial water supplies.

This soil is suitable for building site development and some kinds of onsite waste disposal. Wetness is a limitation on sites for dwellings. Installing tile drains helps to prevent the damage caused by excessive wetness. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability in the fragipan. The wetness, the slope, and seepage are limitations on sites for sewage lagoons. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. The site for the lagoon can be leveled. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

The wetness and frost action are limitations on sites for local roads and streets. Roadside ditches help to lower the water table and thus minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

10E—Killarney very cobbly silt loam, 14 to 50 percent slopes, rubbly. This deep, moderately steep to very steep, moderately well drained soil is on low side slopes and foot slopes in the mountains. The landscape commonly appears corrugated because numerous small ravines have incised the regolith. Stones and boulders cover 1 to 35 percent of the surface. Areas generally are long and narrow or irregularly shaped and in places circle an entire mountain. Most range from about 50 to more than 500 acres in size.

Typically, the surface layer is dark grayish brown very cobbly silt loam about 3 inches thick. The subsurface layer is brown very cobbly silt loam about 4 inches thick. The upper 29 inches of the subsoil is yellowish brown and strong brown very cobbly silt loam and silty clay loam and very gravelly silty clay loam.

The lower 44 inches is a fragipan of brittle, light yellowish brown very gravelly silt loam.

Included with this soil in mapping are areas of the moderately deep, well drained Irondale soils. These soils are on upper slopes and in ravines. Also included are areas of rock outcrop and some areas where stone pavement covers steep drainageways. Included areas make up about 12 percent of the unit.

Permeability is moderately slow above the fragipan in the Killarney soil and very slow in the fragipan. Surface runoff is rapid. The available water capacity is low. Natural fertility and the content of organic matter also are low. The surface layer is friable but is too rocky to be tilled. The rooting depth is restricted by the fragipan. In some periods during winter and spring, a perched water table is above the fragipan. The subsoil has a moderate shrink-swell potential.

Most areas are forested. A few areas have been cleared and are used for pasture. This soil generally is unsuited to cultivated crops, pasture, and hay because of the slope and the rockiness of the surface. Some of the moderately steep slopes, however, can be cleared of stones and used for pasture. These slopes are moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as Caucasian bluestem and indiangrass. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion is a major hazard if the soil is tilled during seedbed preparation. The stones and boulders severely limit tillage unless they are removed.

This soil is suited to trees. The hazard of erosion, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The slope and the stoniness limit the kinds of equipment that can be used. Logging roads and trails can be established on the contour and cleared of large stones and boulders, and logs can be yarded uphill to logging trails in the steepest areas. Seeding trails and disturbed areas after harvesting is completed helps to keep erosion to a minimum. The seedling mortality caused by drought can be minimized by planting the larger seedlings or containerized nursery stock. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. In areas where the forest is mature, tree roots are able to intercept the seepage that this soil receives from the higher elevations. In most areas hand planting is needed. Shortleaf pine can be planted by direct seeding. Properly managing the stand helps to ensure natural regeneration.

damage caused by excessive wetness. Footings and foundations should be reinforced so that they can withstand the shrinking and swelling of the soil. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability in the fragipan. The depth to bedrock, seepage, and the slope are limitations on sites for sewage lagoons. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. The site for the lagoon can be leveled. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

Low strength and frost action are limitations on sites for local roads and streets. Strengthening the base with crushed rock or other suitable material helps to prevent the damage resulting from low strength. Roadside ditches help to lower the water table and thus minimize the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

6D—Delassus silt loam, 5 to 14 percent slopes, bouldery. This deep, moderately sloping and strongly sloping, moderately well drained soil is on ridges in the uplands that commonly abut steep mountainous areas. Stones and boulders commonly cover 0.01 to 0.1 percent of the surface. Most areas are elongated and are about 20 to more than 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil is yellowish brown silty clay loam about 14 inches thick. Below this is a fragipan. The upper part of the fragipan is light yellowish brown, brittle gravelly silt loam. The lower part is reddish yellow, brittle gravelly silty clay loam. Hard rhyolite bedrock is at a depth of about 50 inches. A few stones and boulders and rhyolite cobbles and pebbles are on and below the surface. In some areas red clay is below the fragipan.

Included with this soil in mapping are areas of Killarney soils and rock outcrop. Killarney soils are very cobbly or very gravelly throughout. They are on mountain foot slopes. Included areas make up about 5 percent of the unit.

Permeability is moderately slow above the fragipan in the Delassus soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is low. Natural fertility and the content of organic matter also are low. The surface layer is friable, but it is too stony and bouldery to be tilled. The rooting depth is restricted by the fragipan at a depth of about 25 inches. In some

periods during winter and spring, a perched water table is above the fragipan.

Most areas remain forested. Some areas have been cleared and are used for pasture. This soil is suited to pasture, but it generally is unsuitable for cultivated crops because the stones and boulders interfere with mowing and tillage and can cause equipment damage. Also, erosion and drought are severe hazards.

This soil is suited to some legumes, such as lespedeza and birdsfoot trefoil; to some cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiagrass. It is moderately suited to most legumes and cool-season grasses. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion is a hazard in areas that are tilled before they are seeded. Timely tillage and a quickly established ground cover help to prevent excessive erosion. The stones and boulders severely limit tillage. They can be removed. The main management concerns are preventing overgrazing and maintaining a good stand. Overgrazing causes compaction, deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

This soil is suited to trees. Large stones and boulders limit the use of equipment. Logs can be yarded to logging roads that have been cleared of the stones and boulders. Hand planting or direct seeding is needed.

This soil is suited to building site development and some kinds of onsite waste disposal. Wetness, the shrink-swell potential, and the slope are limitations on sites for dwellings without basements. The wetness is a limitation on sites for dwellings with basements. Installing tile drains and sealing basement walls help to prevent the damage caused by excessive wetness. Footings, foundations, and basement walls should be reinforced so that they can withstand the shrinking and swelling of the soil. Land leveling is needed on sites for dwellings. Also, the dwellings can be designed so that they conform to the natural slope of the land. The soil is generally unsuitable as a site for septic tank absorption fields because of the slope, the wetness, and the very slow permeability in the fragipan. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. Grading can modify the slope. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

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that contains enough water to serve the dwelling. Wetness, the shrink-swell potential, and rockiness are limitations on sites for dwellings without basements. Footings and foundations should be reinforced so that they can withstand the shrinking and swelling of the soil. Installing tile drains helps to prevent the damage caused by excessive wetness. The stones and boulders can be removed. The depth to bedrock is a limitation on sites for septic tank absorption fields. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. The site for the lagoon can be leveled, and enough soil to build the embankment can be borrowed. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

Low strength and frost action are limitations on sites for local roads and streets. Strengthening the base with crushed rock or other suitable material helps to prevent the damage resulting from low strength. Roadside ditches minimize the damage caused by frost action.

The land capability classification is IVe. The woodland ordination symbol is 2X.

6C—Delassus silt loam, 3 to 9 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on foot slopes in the uplands that commonly abut steep mountainous areas. A few stones and boulders cover less than 0.01 percent of the surface. Most areas are irregularly shaped and are about 20 to more than 300 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is brown silty clay loam about 23 inches thick. Below this is a fragipan of brittle loam. The upper 6 inches of the fragipan is grayish brown. The lower part to a depth of 60 inches or more is yellowish brown.

Included with this soil in mapping are areas of Killarney soils and rock outcrop. Killarney soils are very cobbly or very gravelly throughout. They are on mountain foot slopes. Included areas make up about 10 percent of the unit.

Permeability is moderately slow above the fragipan in the Delassus soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is low. Natural fertility and the content of organic matter also are low. The surface layer is friable and can be easily tilled. The rooting depth is restricted by the fragipan at a depth of about 29 inches. In some periods during winter and spring, a perched water table is above the fragipan.

Most areas have been cleared and are used for pasture and hay. Many areas remain forested. This soil

is suited to cultivated crops, hay, and pasture. It is best suited to small grain and drought-tolerant crops because of the low available water capacity.

The main management concerns in cultivated areas are keeping erosion to a minimum, reducing the hazard of drought, and maintaining tilth and fertility. Terraces, a system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, and grassed waterways can reduce the hazard of erosion. Where terraces are constructed, the fragipan can hinder revegetation after construction. The depth of the terrace cut and the design of the terrace system should be adjusted so that infertile soil is not exposed in small areas. Because the soil is easily eroded, the terraces should be closely spaced or should be used in conjunction with a conservation tillage system. Some type of grade stabilization structure generally is needed in grassed waterways. Crop rotations in which grasses and legumes are grown in about 2 years out of 3 help to control erosion. Conservation tillage can increase the number of years in which cultivated crops are included in the rotation. Conservation tillage and additions of manure, lime, and fertilizer help to keep the soil in good tilth and maintain fertility.

This soil is moderately well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiagrass. The rooting depth is only moderate, and droughtiness is a problem during part of the growing season. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion is a hazard in areas that are tilled before they are seeded. Timely tillage and a quickly established ground cover help to prevent excessive erosion. The main management concerns are preventing overgrazing and maintaining a good stand. Overgrazing causes compaction, deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Excessive rut formation and miring are problems when the soil is wet. The use of equipment should be delayed until the soil is dry. Adding gravel or other suitable material to the main logging roads helps to prevent excessive rut formation and miring.

This soil is suitable for building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations on sites for dwellings. Installing tile drains helps to prevent the

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well drained Crider soils and small areas of soils that have a fragipan. The included soils are in landscape positions similar to those of the Fourche soil. They make up about 15 percent of the unit.

Permeability is moderately slow in the Fourche soil. Surface runoff is medium. The available water capacity is high. The surface layer is friable and can be easily tilled. Natural fertility is moderately low, and the content of organic matter is low. The number of roots decreases gradually with increasing depth. The soil has few roots below a depth of about 3 feet. A perched water table is in the subsoil during winter and spring. It is at a depth of 1.5 to 3.0 feet in most years. The shrink-swell potential is moderate in the subsoil.

Most areas have been cleared and are used for pasture and hay. This soil is well suited to cultivated crops. The main management concerns are keeping erosion to a minimum, minimizing compaction, and maintaining tilth and fertility. Terraces, a system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, grassed waterways, and contour farming help to control erosion. Because the soil is easily eroded, the terraces should be closely spaced or should be used in conjunction with a conservation tillage system. Some kind of grade stabilization structure is needed in grassed waterways. Crop rotations in which grasses and legumes are grown in about 1 year out of 3 help to control erosion. Conservation tillage can increase the number of years in which cultivated crops are included in the rotation. Plowpans or traffic pans form readily in cultivated fields. Subsoiling or chiseling and reducing the number of trips over the field help to maintain favorable rooting conditions. Conservation tillage and additions of manure, lime, and fertilizer help to keep the soil in good tilth and maintain fertility.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as smooth brome and orchardgrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. No serious problems affect pasture or hayland. Erosion is a hazard in areas that are tilled before they are seeded. Timely seedbed preparation helps to ensure a good ground cover. The main management concerns are preventing overgrazing and maintaining a good stand. Overgrazing causes compaction, deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

Some areas support native hardwoods. This soil is suited to trees and orchards. Woodlots should be

protected against grazing and trampling by livestock. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and some kinds of onsite waste disposal. Wetness and the shrink-swell potential are limitations on sites for dwellings. Installing tile drains helps to prevent the damage caused by excessive wetness. Footings, foundations, and basement walls should be reinforced so that they can withstand the shrinking and swelling of the soil. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. The site for the lagoon can be leveled. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

Low strength, wetness, and frost action are limitations on sites for local roads and streets. Strengthening the base with crushed rock or other suitable material helps to prevent the damage resulting from low strength. Roadside ditches help to lower the water table and thus minimize the damage caused by wetness and frost action.

The land capability classification is 11e. The woodland ordination symbol is 3A.

20C—Fourche silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridges and the upper side slopes in the uplands. Most areas are irregular in shape and range from about 20 to more than 200 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown silty clay loam, the next part is brown silty clay loam that has light brownish gray silt coatings, and the lower part is yellowish red, mottled silty clay. In some severely eroded areas, the surface layer is silty clay loam. In some places the depth to bedrock is less than 60 inches, and in other places the bedrock is sandstone rather than dolomite.

Included with this soil in mapping are small areas of soils that have a fragipan. These soils are in landscape positions similar to those of the Fourche soil. They make up about 10 percent of the unit.

Permeability is moderately slow in the Fourche soil. Surface runoff is medium. The available water capacity is high. The surface layer is friable and can be easily tilled unless it is severely eroded. Natural fertility is moderately low, and the content of organic matter is

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This soil generally is unsuitable for building site development and onsite waste disposal because of the slope and the large stones.

The land capability classification is VIIs. The woodland ordination symbol is 3R.

11C—Lebanon silt loam, 3 to 9 percent slopes.

This deep, gently sloping and moderately sloping, moderately well drained soil is on wide ridgetops and divides in the uplands. Areas generally are elongated or irregularly shaped and range from about 20 to more than 200 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. The part of the subsoil above a fragipan is about 20 inches of strong brown silt loam, brown silty clay loam, and grayish brown silty clay and silty clay loam. The fragipan is about 20 inches of pale brown, brittle extremely cherty silt loam and yellowish brown, brittle cherty silty clay loam. The lower part of the subsoil to a depth of 60 inches or more is yellowish brown cherty silty clay. In some eroded areas the surface layer is brown silty clay loam.

Included with this soil in mapping are areas of Wilderness soils. These soils contain more chert than the Lebanon soil. They are in landscape positions similar to those of the Lebanon soil. They make up about 5 percent of the unit.

Permeability is moderately slow above the fragipan in the Lebanon soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is low. The surface layer is friable and can be easily tilled. Natural fertility and the content of organic matter are low. The rooting depth is restricted by the fragipan at a depth of about 25 inches. In some periods during winter and spring, a perched water table is above the fragipan. The shrink-swell potential is moderate.

Most areas have been cleared and are used for pasture and hay. Many areas remain forested. This soil is suited to cultivated crops, hay, and pasture. It is best suited to small grain and drought-tolerant crops because of the low available water capacity.

The main management concerns in cultivated areas are keeping erosion to a minimum, reducing the hazard of drought, and maintaining tilth and fertility. Terraces, a system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, grassed waterways, and contour farming help to control erosion. Where terraces are constructed, the fragipan can hinder revegetation. The depth of the terrace cut and the design of the terrace system should be adjusted so that infertile soil is not exposed in small areas. Because the soil is easily eroded, the terraces

should be closely spaced or should be used in conjunction with a conservation tillage system. Some type of grade stabilization structure commonly is needed in grassed waterways. Crop rotations in which grasses and legumes are grown in about 2 years out of 3 help to control erosion. Conservation tillage can increase the number of years in which cultivated crops are included in the rotation. Conservation tillage and additions of manure, lime, and fertilizer help to keep the soil in good tilth and maintain fertility.

This soil is moderately well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiagrass. The rooting depth is moderate, and droughtiness is a problem during part of the growing season. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion is a hazard in areas that are tilled before they are seeded. Timely tillage and a quickly established ground cover help to prevent excessive erosion. The main management concerns are preventing overgrazing and maintaining a good stand. Overgrazing causes compaction, deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

This soil is suited to trees. Windthrow is a hazard. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Excessive rut formation and miring are problems when the soil is wet. The use of equipment can be delayed until the soil is dry. Adding gravel or other suitable material to the main logging roads minimizes rut formation and miring. In places roads can be located on nearby soils that are less prone to rut formation and miring.

This soil is suited to woodland wildlife habitat. The habitat can be improved by providing food, water, and cover in large tracts of mature woodland. Brushy thickets, which are created by clearing small areas, provide habitat diversity. The soil conditions favor the establishment of green browse areas, annual grain plots, and wild herbaceous plants. The soil is suitable for the development of small ponds, which can provide water in areas that are remote from perennial water supplies.

This soil is suitable for building site development and some kinds of onsite waste disposal. Wetness and the shrink-swell potential are limitations on sites for dwellings. Installing tile drains helps to prevent the damage caused by excessive wetness. Footings,

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Killarney, Knobtop, and Taumsauk soils. Killarney soils are deep and have a fragipan. They are on the lower slopes and on small ridges between drainageways. Knobtop soils have less than 35 percent rock fragments. They are on narrow ridges and in the less sloping areas in the mountains. Taumsauk soils are shallow. They are in scattered areas throughout the unit. Also included are outcrops of rhyolite and similar igneous rocks in glade areas on the upper side slopes. Included areas make up about 15 percent of the unit.

Permeability is moderate in the Irondale soil. Surface runoff is rapid. The available water capacity is low. Natural fertility also is low, and the content of organic matter is moderately low. The surface layer is friable, but it cannot be easily tilled because it commonly has 50 percent or more rock fragments. The rooting depth is limited by the hard bedrock. The shrink-swell potential is low.

Most areas are forested, except for the natural openings in the glades. Because of the slope, the rock fragments on the surface, and droughtiness, this soil is unsuitable for field crops, hay, and pasture. It is suited to trees. It is best suited to short rotations for small wood products, such as fuelwood and posts, in areas on south- and west-facing slopes, where productivity is low. Productivity is moderate on north- and east-facing slopes. The hazard of erosion, the equipment limitation, and seedling mortality are management concerns. Erosion generally occurs along logging trails. It can be controlled by seeding the trails after harvesting is completed. The slope and the rocky surface limit the use of equipment. Logging roads and trails can be established on the contour and cleared of large stones and boulders, and logs can be yarded to the logging trails. The seedling mortality caused by drought can be minimized by planting the larger seedlings or containerized nursery stock. Hand planting or direct seeding is needed. Properly managing the stand helps to ensure natural regeneration.

This soil is best suited to woodland wildlife habitat. Even though the opportunities for intensive habitat management are limited in most areas, the habitat provides food, water, cover, and nesting areas. The existing vegetation consists mainly of an oak-hickory forest interspersed with shortleaf pine in places. Glades in the included areas of Taumsauk soils are natural openings in the otherwise extensive forest. These shallow soils support various forbs and native grasses, such as sumac, coralberry, little bluestem, and indiagrass. Small ponds can provide water in areas that are remote from perennial water supplies.

This soil generally is unsuitable for building site

development and onsite waste disposal because of the slope, the depth to bedrock, and the rockiness of the surface.

The land capability classification is VIIIs. The woodland ordination symbol is 2X.

43E—Syenite silt loam, 10 to 25 percent slopes, extremely bouldery. This moderately deep, strongly sloping to steep, well drained soil is on smooth, convex side slopes in the uplands. Stones and boulders cover 3 to 15 percent of the surface. Most areas are irregular in shape and range from about 100 to more than 300 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is strong brown silty clay loam, the next part is brown clay loam, and the lower part is pale brown gravelly clay loam. Hard red granite bedrock is at a depth of about 31 inches. In places the surface layer is gravelly silt loam.

Included with this soil in mapping are areas of a shallow, somewhat excessively drained soil and areas of rock outcrop. The included areas are in landscape positions similar to those of the Syenite soil. They make up about 10 percent of the unit.

Permeability is moderately slow in the Syenite soil. Surface runoff is rapid. The available water capacity is low. Natural fertility and the content of organic matter also are low. The surface layer is friable, but it is too stony and bouldery to be tilled. The rooting depth is restricted by the bedrock.

Most areas are forested. A few areas are used for pasture. Most of the pastured areas have slopes of less than 20 percent and have fewer stones and boulders than the forested areas. Because of the slope and the large rocks on the surface, this soil is unsuitable for cultivated crops and hay. It is suited to some legumes, such as lespedeza and birdsfoot trefoil; to some cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, Caucasian bluestem, and indiagrass. It is moderately suited to most legumes and cool-season grasses. Shallow-rooted species that can tolerate droughtiness should be selected for planting. Erosion is a hazard in areas that are tilled before they are seeded. Timely tillage and a quickly established ground cover help to prevent excessive erosion. The stones and boulders interfere with tillage and can cause equipment damage. The main management concerns are preventing overgrazing and maintaining a good stand.

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low. The number of roots decreases gradually with increasing depth. The soil has few roots below a depth of about 3 feet. A perched water table is in the subsoil during winter and spring. It is at a depth of 1.5 to 3.0 feet in most years. The shrink-swell potential is moderate in the subsoil.

Most areas have been cleared and are used for pasture and hay. This soil is suited to cultivated crops. The main management concerns are keeping erosion to a minimum, minimizing compaction, and maintaining tilth and fertility. Terraces, a system of conservation tillage that leaves protective amounts of crop residue on the surface, winter cover crops, grassed waterways, and contour farming help to control erosion. Because the soil is easily eroded, the terraces should be closely spaced or should be used in conjunction with a conservation tillage system. Some type of grade stabilization structure generally is needed in grassed waterways. Crop rotations in which grasses and legumes are grown in about 2 years out of 3 help to control erosion. Conservation tillage can increase the number of years in which cultivated crops are included in the rotation. Plowpans or traffic pans form readily in cultivated fields. Subsoiling or chiseling and reducing the number of trips over the field help to maintain favorable rooting conditions. Conservation tillage and additions of manure, lime, and fertilizer help to keep the soil in good tilth and maintain fertility.

This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as smooth brome and orchardgrass; and to warm-season grasses, such as big bluestem, indiagrass, and switchgrass. No serious problems affect pasture or hayland. Erosion is a hazard in areas that are tilled before they are seeded. Timely seedbed preparation helps to ensure a good ground cover. The main management concerns are preventing overgrazing and maintaining a good stand. Overgrazing causes compaction, deterioration of the stand, and excessive runoff. Proper stocking rates, pasture rotation, deferred grazing, and applications of fertilizer help to keep the pasture in good condition.

Some areas support native hardwoods. This soil is suited to trees and orchards. Woodlots should be protected against grazing and trampling by livestock. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and some kinds of onsite waste disposal. Wetness and the shrink-swell potential are limitations on sites for dwellings. Installing tile drains helps to prevent the damage caused by excessive wetness. Footings,

foundations, and basement walls should be reinforced so that they can withstand the shrinking and swelling of the soil. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. A properly designed sewage lagoon or another disposal system, such as a mound system, can provide adequate waste treatment. The site for the lagoon can be leveled. Sealing the bottom of the lagoon helps to prevent contamination of the ground water.

Low strength, wetness, and frost action are limitations on sites for local roads and streets. Strengthening the base with crushed rock or other suitable material helps to prevent the damage resulting from low strength. Roadside ditches help to lower the water table and thus minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

22D—Wilderness very cherty silt loam, 5 to 14 percent slopes. This deep, moderately sloping and strongly sloping, moderately well drained soil is on ridges in the uplands. Most areas are long and narrow and follow the irregular pattern of drainage divides. The areas range from about 20 to more than 1,000 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is brown and yellowish brown very cherty silt loam about 11 inches thick. The upper part of the subsoil is strong brown very cherty silty clay loam about 9 inches thick. The next part is a fragipan of yellowish brown very cherty silt loam about 26 inches thick. The lower part to a depth of 60 inches or more is strong brown very cherty silty clay loam. In places the fragipan is 3 or more feet thick.

Included with this soil in mapping are areas of Lebanon soils. These soils contain less chert than the Wilderness soil. They are on gently sloping ridgetops. They make up about 5 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Wilderness soil and slow in the fragipan. Surface runoff is medium. The available water capacity is very low. The content of organic matter and natural fertility are low. The surface layer is friable and has a large amount of chert gravel. The rooting depth is restricted by the fragipan at a depth of about 2 feet. In some periods during winter and spring, a perched water table is above the fragipan.

Most areas are forested. A few areas have been cleared and are used for pasture. This soil is unsuited

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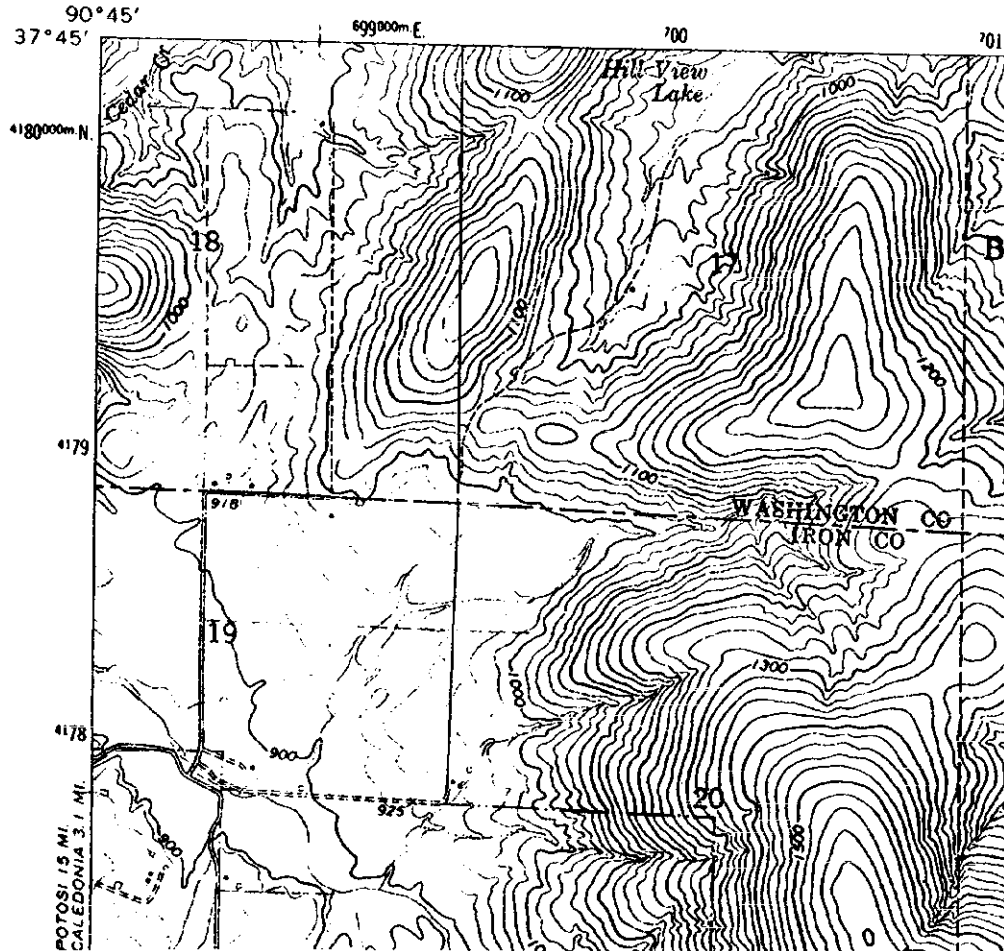
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Notes To Detail Map

- 1) Permit (bonded area) boundary. This is shown on the map to be no more than 8 acres.
- 2) The property line is shown in a thick black line. The property is approximately 285 acres with the surface and subsurface rights owned by John McManus, LLC. The latter ownership is noted on the map's legend
- 3) There are no public roads located in or within one hundred feet (100') of the permit area.
- 4) There are no terraces, waterways, and diversions within the Mine Plan Area
- 5) The entire mine area will be returned to wilderness with a 10 acre pond.
- 6) North area and map scale shown in legend.
- 7) Company Name: Dillon Llewellyn, LLC
Permit Number: To Be Supplied by DNR: _____
County: Iron
Site Name: MB Traprock
Legal Description: T34N, R3E, Section 12
Date: August 2, 2002
Preparer: M. Albert
- 8) No creeks or streams within one hundred feet (100') of the permit area
- 9) No areas within the permit boundary were mined prior to August 28, 1990.
- 10) There are no locations of abandoned underground or surface mines in, or adjacent to, the permit area.
- 11) There are no locations of acid or toxic forming materials.
- 12) Erosion control berm placed at the entrance to processing/pit area east of 8 acre initial disturbance.
- 13) The railroad road bed/track lease area and the power line easement as marked will be protected. The power line is in its actual location as constructed. The railroad road bed location is approximate and will be based on the location as used by the railroad company.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



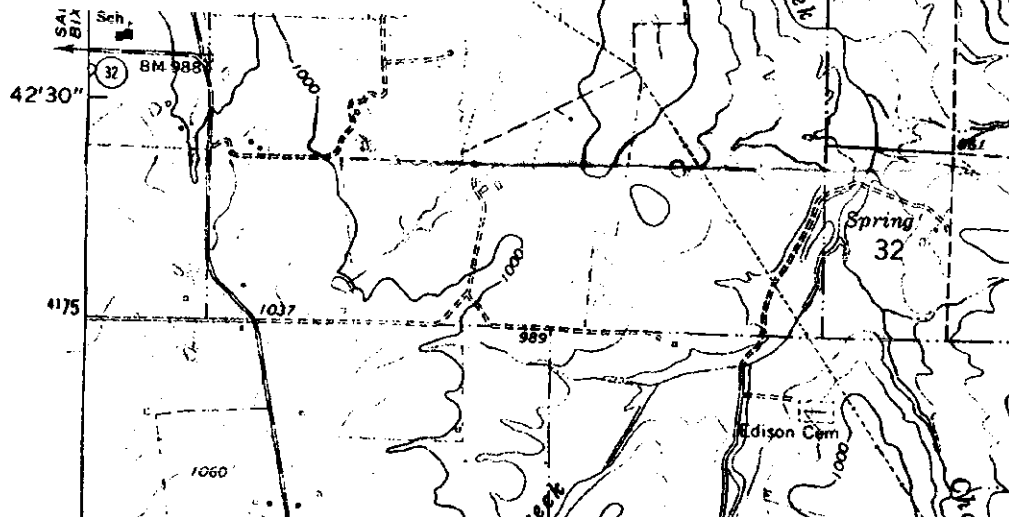
LOCATOR MAP

Company:	Dillon Llewellyn, LLC
Permit #:	
County:	Iron County
Site Name:	MB Traprock
Legal Description:	T34N, R3E, Section 12
Date:	August 1, 2002
Preparer:	M. Albert, Project Manager

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DETAIL MAP

Map Source: Enlargement/USGS 7.5 minute map
Surface/Subsurface Owner: John McManus, LLC
North ↑
Scale 1" = 200'

Existing Roadways
Railroad
Property Boundary
Mine Area Boundary

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Company: Dillon Llewellyn, LLC
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M. Albert, Project Manager

